

ETH Zürich Foundation

Uplift

The impact of giving N°21

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an ultra-efficient solar car**
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Funding focus

**Education for
the future**

Ready? Ready!



ETH Zürich / Markus Bertschi

Günther Dissertori
Rector of ETH Zurich

The future is by its very nature uncertain, and in today's geopolitical climate, it seems harder than ever to predict. Yet when it comes to technological progress, we stand at the forefront. Our leadership in fields such as artificial intelligence, our excellent teaching and our close links with industry allow us – at least in science – to look ahead with confidence. Our goal is to equip students with the best possible tools to tackle tomorrow's challenges. At the same time, we aim to foster resilience, a constructive attitude towards mistakes and opportunities for hands-on experience early in their studies.

On the following pages, you'll find a few glimpses of what this means in practice. Are you curious about how artificial intelligence could create new opportunities in teaching? Would you like to discover how students and companies are driving innovation together? Or how we are helping our students to become more critical and responsible members of society? I warmly invite you to find out.

Günther Dissertori

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For details on ETH Zurich's
vision for teaching:



Smarter learning with AI

How can large language models become tutors with real pedagogical value? This is the question doctoral student Jakub Mačina is exploring at the intersection of natural language processing and learning sciences.

Type a question into ChatGPT, Gemini or Claude – and within seconds the answer pops up on the screen. Efficient, yes, but not necessarily conducive to lasting learning. Jakub Mačina, fellow at the ETH AI Center, is tackling the challenge of how large language models (LLMs) need to be programmed so they can genuinely support students in their individual learning journeys.

Step by step to real learning

“LLMs are good at solving problems and delivering answers. But in an educational setting, it’s the student who needs to do the thinking and actively engage with the material,” Jakub Mačina says. At the ETH AI Center, he is developing models that act as collaborative partners to students. Rather than giving away the solution, the models provide prompts and guidance that help learners build understanding step by step. For his work, Jakub Mačina draws on proven pedagogical concepts from learning sciences, such as Socratic questioning – targeted follow-up questions that stimulate independent thinking – and productive failure. This approach, developed by ETH Professor Manu Kapur, presents learners with problems that are still beyond their ability to solve. The trial-and-error method activates prior knowledge and heightens the “aha” effect when the explanation is given.

To achieve this, Jakub Mačina works with open-source models, such as Apertus from the Swiss AI Initiative, and develops his own open-source models like TutorRL, which supports students in solving maths problems. For now, his focus is on secondary and high school levels, but eventually the models will also be able to assist with university-level STEM questions. He has also created MathTutorBench, a benchmarking tool that not only assesses whether a tutoring model provides the right answer but, more importantly, how it teaches.

Humans and AI in collaboration

“LLMs for tutoring are becoming increasingly popular,” Jakub Mačina observes. Major players now offer tailored models, such as Gemini’s LearnLM or OpenAI’s Study mode. In Switzerland too, there are various providers, including the AI app Tutor.new, developed by two ETH students. While he sees these as exciting applications, he notes that currently they tend to be more suited to a private tutoring setting – and not for use in the classroom.

His research aims to fill this gap. So does this mean the classroom of tomorrow will take place at home with an AI tutor? Jakub Mačina shakes his head. “It’s not about replacing teachers, but about making their work more



ETH Foundation / Daniel Winkler



Tradition meets tomorrow: Wilhelm Gimmi's mural *Teaching and Learning* (1955) in ETH's main building illustrates the evolution of knowledge transfer.

efficient." He sees AI models as complementary: students can learn at their own level while teachers gain more time for individual support. On top of that, insights from the models can help optimise teaching by showing at which stage of problem-solving students run into difficulties.

Making education more accessible

According to Jakub Mačina, the human element could become even more important in the future. LLMs are changing how a learner's knowledge can be tested and monitored. He envisions a shift back to in-person written and oral exams, where students must critically reflect on machine-generated answers and demonstrate understanding of the processes involved. "Like back in

the day, when you had to solve programming problems on paper," he laughs, remembering his computer science studies at the Faculty of Informatics and Information Technologies STU in Bratislava.

Before joining the ETH AI Center, Jakub Mačina worked for four years as a developer at Exponea, a tech start-up specialising in customer data analytics and marketing automation, which was acquired by US provider Bloomreach in 2021. His return to research was motivated by a desire to apply his expertise in personalisation to the education sector. "I want to help ensure that high-quality, individualised education does not remain the privilege of a few," says the doctoral student, who got his first taste of ETH as an intern at the Paul Scherrer Institute back in 2016.

Thanks to his fellowship funded by the Asuera Stiftung, he is now able to pursue this goal at the ETH AI Center, developing new interdisciplinary tools and solutions that hopefully find their way into the educational landscape. With his entrepreneurial background, Jakub Mačina certainly has the experience to make it happen.

AI Fellowship programme

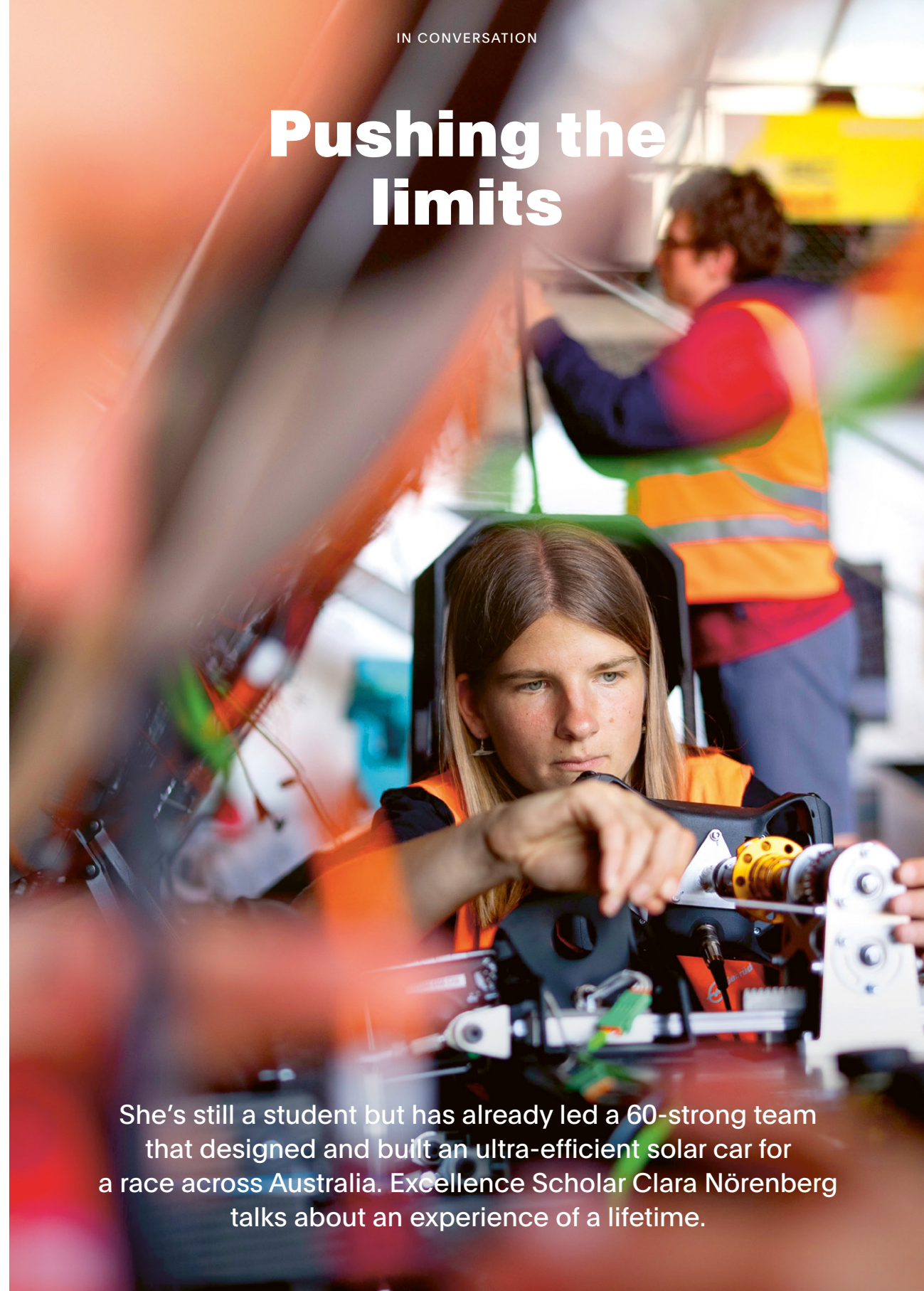
Research fellowships for outstanding international doctoral and postdoctoral students form one of the main pillars of the ETH AI Center. The fellows' work spans everything from basic research to practical applications in areas such as robotics, digital health, learning sciences and language processing. The fellowships are largely made possible by donations.



Find out more:
ethz-foundation.ch/en/eth-ai-center

IN CONVERSATION

Pushing the limits



She's still a student but has already led a 60-strong team that designed and built an ultra-efficient solar car for a race across Australia. Excellence Scholar Clara Nöenberg talks about an experience of a lifetime.



aCentauri Solar Racing

The car that set off in Darwin, Australia, in August 2025 is thirty times more efficient than a conventional passenger vehicle. It was built in the ETH hangar at the Zurich Innovation Park in Dübendorf.

You grew up in England and completed your A-levels in Oxford. What made you choose to study mechanical engineering at ETH Zurich?

CLARA NÖRENBERG – I first discovered ETH Zurich during an open day for prospective students. The presentations on student projects in mechanical engineering were what convinced me – I hadn't seen anything comparable at universities in England. I was also attracted by the demanding lecture schedule at ETH. I think both aspects are important: starting with a solid theoretical foundation, you can then develop your engineering intuition through real projects.

How did you become project leader of aCentauri, the student team that has now taken part twice in the World Solar Challenge across Australia?

I had already joined the project during my bachelor's degree. After returning from the first race, I was incredibly motivated to lead the project into the next one. As one of the few people from the original team who wanted to continue, I was the obvious

choice. And, of course, leadership also comes with organisational responsibility. Many of my team colleagues love the technical challenges – but the organisational side of things less.

What have you learned about teamwork and leadership over the past year? Everything depends on the team. As a leader, you need to keep an overview and know how to delegate. Communication and the way you deal with others are absolutely crucial. Trust is another key factor: a leader must trust the team, and the team must trust its leader. Everyone needs to be confident that each person is doing their best and not get frustrated if others occasionally take more time off. Another

“The step from ‘designing something’ to ‘making a whole system work’ is huge. Anyone who takes part in a project like aCentauri proves they can make that step.”

valuable lesson was that success often depends less on what you know and more on how you make use of your resources. For instance, we reached out to our sponsors several times when they had specific expertise we lacked – for example, in battery systems. And finally, how do you find the right compromises? An important insight for me was that the technically best solution isn't necessarily the best one for the project. The team has to be on board. If someone isn't motivated, they may not implement a solution as effectively.

And in terms of hard skills – what have you taken away from the project? I've learned how to build a functioning solar car, and I now have a solid understanding of both the electrical and mechanical aspects. Initially, I was part of the subteam that developed the cockpit, which is made of carbon fibre-reinforced plastics. That's where I learned how to design and build with this material, and I also picked up skills in aerodynamics.

How does a project like aCentauri help to push the boundaries of technology? Because it's not a car for everyday use, we can push boundaries by focussing purely on building the fastest, most reliable and most efficient solar car possible – without worrying about market potential. We use the very best solar cells, even if they're the most expensive. We optimise everything, even if it wouldn't make commercial sense in the real world, and that's how we find out what's truly possible. We also don't need to think about how the car looks, which is otherwise one of the most powerful factors in the market.

Did the project also push you all to your personal limits? It was definitely an intense time for all of us. These projects are known for being a once-in-a-lifetime learning experience

– which is precisely why you can find 60 people willing to commit to such a complex project alongside their already demanding studies, often without earning a single ECTS credit for it. During the most intense phase, some team members were putting in 60 to 80 hours a week.

You covered 3,000 kilometres in 44.7 hours this time, finishing 11th out of 26 teams. Are you happy with that? We were six hours faster than two years ago – that's more than a ten per cent improvement. Our efficiency was on a par with the top teams, which shows how much progress we've made. But we also know what needs to be improved for the next car.

So what's ahead? Several members of the current team have already said they want to continue and take part again in two years. I'll stay involved with aCentauri in an advisory role – and I have a feeling that solar cars will continue to play a part in my life.

Project-based learning at ETH

At ETH Zurich, students are encouraged to gain hands-on experience through real-world projects. Initiatives and formats like the focus projects, the Center for Project-Based Learning (pbl.ee.ethz.ch) and the Student Project House (p.10) have greatly expanded in recent years and will continue to grow. They give students the chance to learn how to translate theoretical knowledge into practical solutions.

Grown in the creative workshop

Thanks to private donations, the Student Project House at ETH Zurich provides fertile ground for initiatives where students can flourish as makers and innovators. Here, they test ideas, build prototypes and connect with like-minded people. A selection of projects and start-ups that began life in the Student Project House:

Autonomous River Cleanup: clean rivers through technology

This student project from the Robotic Systems Lab uses robotics and machine learning to tackle water pollution and develop new strategies for circular waste management.

Fabas: the versatile bean protein

This start-up delivers bean-based ingredients that help create sustainable, nutrient-rich alternatives to animal products – using only pulses grown from regenerative agriculture in Switzerland.

Riverkin: high-resolution freshwater monitoring

Riverkin sensors make it possible to track water quality, support nature conservation and improve water management. The technology, developed by Jessica Droujko, helps to quantify risks such as flooding and take appropriate action.

Sophia Edu Labs: a supportive AI tutor

Two ETH master's students in computer science have launched a start-up to offer high-quality, affordable one-to-one online tutoring.

Synature: smart microphones for biodiversity

These intelligent microphones can recognise more than 10,000 species by sound, autonomously recording data on biodiversity. This enables efficient monitoring of conservation and regenerative agriculture measures.

Tethys Robotics: powerful underwater drone

Jonas Wüst and Pragash Sivananthaguru have developed a drone that can navigate underwater using acoustic sensors – making it ideal for tasks such as search operations in strong currents.

Treeless: cellulose without trees

Can packaging, adhesives and cosmetics be developed without using synthetic or harmful substances? Treeless is researching and producing bio-based materials made from cellulose – entirely wood-free and created by microorganisms.

Unbound Potential: a new kind of battery

The ETH spin-off's redox flow battery makes long-term storage of renewable energy more cost-effective, sustainable and efficient. By using immiscible electrolytes, it operates without a membrane for ion transfer.

More space for inventing and experimenting

The Student Project House already receives support from the Asuera Stiftung, Baugarten Stiftung, Inger and Dr Norbert Bischofberger, Ernst Göhner Foundation, Fondation Alcea, Franke, Dipl. Ing. Walter Fust, Georg H. Endress Stiftung, Georg und Bertha Schwyzer-Winiker Stiftung, Petra König Pirola, Plastic Omnium, Stiftung e-na'bel, Trilogos Fonds and Georg Wacker. Two new goals to be developed with partners are the launch of a state-of-the-art Food Lab and the expansion of the Digital Makerspace.

 ethz-foundation.ch/en/student-project-house

"Technology is the smallest part"

With quiet pride, Sabrina Badir looks back on the ten-year journey of her ETH spin-off, Pregnolia. At the same time, she feels a sense of connection with the next generation of ETH entrepreneurs who are only just starting out.

You're a movement scientist. How did you end up founding a start-up in pregnancy care?

SABRINA BADIR – During my studies I was increasingly drawn to biomechanics and medicine, so I attended mechanical engineering lectures to gain the fundamentals of mechanics. I wrote my master's thesis at the Institute for Mechanical Systems, which had long collaborated closely with clinicians to apply mechanical principles to medical diagnostics and therapy. For example, the technology behind Pregnolia was already the product of ten years of prior research. My doctoral project explored its application in connection with changes in the cervix. I realised that the hospitals involved were very interested in continuing the study beyond my doctorate and eventually developing a device to measure cervical stiffness – which had emerged as a highly relevant biomarker for pregnancy care. But it wasn't until I heard about the ETH Pioneer Fellowship Programme that I considered becoming an entrepreneur myself.

How were your first steps on that path?
Through the Pioneer Fellowship, I learned how to turn a scientific paper into a

business. As a scientist, my world had revolved around the technology I was developing. As a young entrepreneur, I realised that the technology would be the smallest part of my company's success. I was incredibly curious, full of questions and eager to find answers – it opened up an entirely new world for me. What I find so wonderful about this world is how open all these extremely busy people are. Other entrepreneurs know how challenging – and often lonely – this path can be, so they support one another wherever possible.

Where is Pregnolia today?

We've come a long way. Over the past ten years, we've turned an idea into a product that's approved for use in Europe. We've generated entirely new data showing that a softer cervix is associated with an increased risk of preterm birth. We've also succeeded in being recognised by the scientific community as a pioneering company set to improve prenatal care. Today we collaborate with world-leading gynaecologists from the UK, the Netherlands, Italy and the USA – experts who present Pregnolia's work at major conferences to help pave the way for its adoption in clinics. We also man-



ETH Zürich / Markus Bertschi

“We want to make prenatal check-ups for millions of pregnant women around the world more precise and proactive.”

aged to convince investors of our business case even before the Femtech industry existed and gender medicine was a buzzword. To achieve all this, we’ve had to alter our strategy several times.

What’s next?

As mentioned, our measuring device is approved, but that’s not enough on its own. We need guidelines that allow doctors to make informed decisions based on the measurements. These guidelines can only be developed through large-scale studies. Caring for pregnant women is a particularly sensitive area, which means extensive clinical data is required.

So we need to collect even more data. We’re also working on gaining approval for the US market. Our long-term vision is clear: we want the measurement of cervical stiffness to become a new clinical standard – not just to improve care for high-risk pregnancies, but to make prenatal check-ups for millions of women worldwide more precise and proactive. Compared with traditional methods such as palpation or ultrasound-based assessment of cervical length and dilation, the Pregnolia system is far superior. But for a global roll-out, it will take a different kind of expertise – one that goes beyond what our current team has built. That’s why our aim is to reach a stage where a larger company can take Pregnolia further. We’re already in talks to form such a strategic partnership.

Pregnolia won the 2025 Femtech World Award for Innovation in Obstetrics and Gynaecology. What does this mean to you? This kind of external validation and visibility is wonderful – and extremely important

for us. The Femtech World Awards are organised in the UK, which helps us a lot there, especially since we can’t yet afford large-scale marketing campaigns.

Would you consider giving something back to ETH Zurich if your current strategy for Pregnolia succeeds?

Absolutely! That’s exactly why I signed the ETH Founder’s Pledge. Without ETH and its donors, Pregnolia would never have come into being. So for me, it’s only right that success should flow back to ETH. More broadly, I think it’s important to remember that generations are connected to each other – especially in a time so marked by individualism. Supporting young entrepreneurs fits perfectly with a connectivity mindset.

The ETH Founder’s Pledge

With a Founder’s Pledge, entrepreneurs emerging from ETH Zurich make a non-binding pledge to support ETH and its future generations with acts of philanthropy. Founders such as Lukas Böni of Planted and Philipp Furler of Synhelion have already made the commitment, paving the way for a sustainable, connected start-up community at ETH.



Learn more:
ethz-foundation.ch/en/founderspledge

For techies with an ethical compass

To strengthen sustainability and ethics in teaching, ETH Zurich has launched a university-wide project that embeds these themes across all its degree programmes.



“Before you are engineers, you are human beings.”

Francesco de Sanctis



Plaque in the ETH Main Building: Italian scholar Francesco de Sanctis was the first Professor of Italian Literature at ETH. The phrase: “prima di essere ingegneri voi siete uomini” – or “before you are engineers, you are human beings” – stems from his inaugural lecture in 1856 and became the guiding principle of the then Polytechnic’s early humanist faculty.

After completing their studies, ETH Zurich’s graduates are uniquely positioned to drive technological progress in science, industry and society. In doing so, the skills they have gained in developing complex technologies should be put to use in the service of democracy, fairness and sustainability. To meet this ambitious goal, students need more than an outstanding disciplinary education – something ETH has long been renowned for. They also need

broader skills, including a deeper, more holistic understanding of sustainability, ethics and social contexts.

Ethics, in this sense, is about reflecting on moral principles and social values while sustainability concerns the responsible, forward-looking use of resources – meeting today’s needs without compromising the ability of future generations to meet theirs. Until now, these two perspectives

have not been systematically integrated into ETH’s curricula. The new initiative “Sustainability and Ethics” aims to plug the gap.

Responsible decisions

Going forward, the two topics will be revisited, built upon and explored in increasing depth across all degree programmes. The goal is to empower students to make responsible decisions and to actively contribute to tackling global challenges such as climate change, technological justice and fair resource distribution. Even more than today, ETH graduates will be encouraged to act as “Change Agents for a Better Tomorrow”, consciously helping to shape the world in a positive way. As all degree programmes are being reviewed as part of the PAKETH education reform, this presents a unique opportunity to set the right course for the future.

Philanthropy creates momentum

The initiative is designed to have a broad and lasting impact across the university. Using a spiral curriculum, theoretical and practical applications of concepts and theories alternate with guided reflection. This approach allows students to develop hands-on skills in values-based design, systems thinking, stakeholder analysis and civic engagement.

At the same time, the project enables ETH lecturers to integrate sustainability and ethics meaningfully into their teaching. Many lecturers want to address these topics but are hindered by time constraints, limited resources, or uncertainty about how to teach them effectively. To help overcome these obstacles, the initiative provides teaching materials, peer-exchange platforms and continuing education in didactics. Incentives such as project

funding, teaching awards and visibility at key ETH events will further boost motivation and institutional recognition. Together, these measures lay the groundwork for a lasting cultural shift – one that firmly establishes sustainability and ethics as integral elements of excellent scientific and engineering education.

To succeed with this transformation, ETH Zurich also depends on the support of donors and partners. Those who share this holistic vision of excellence in education and wish to strengthen the role of sustainability and ethics in teaching are warmly invited to reach out to the ETH Foundation.

“Education should not only enable young people to acquire technical expertise, but also imagine a desirable future – and their own role within it.”



Professor Joël Mesot
President of ETH Zurich,
Vice President ETH Foundation



In the focus projects, small student teams spend two semesters developing a market-oriented product. Pictured: Geranos, a drone for transporting heavy poles by air.

Alessandro Della Bella / ETH Zürich

Your support

Whether it's in energy and climate, digitalisation or public health – science and technological innovation offer tremendous opportunities for creating a more resilient and sustainable society. What makes the difference is excellent research and teaching, strong partnerships – and you.

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